

DOCUMENT RESUME

ED 201 402

PS 012 148

AUTHOR Cocking, Rodney R.
 TITLE The Dominance of Spatial Memory over Color or Form in 3- to 5-Year-Olds' Pattern Reconstructions.
 PUB DATE Feb 80
 NOTE 10p.; Paper presented at the Annual Interdisciplinary UAP-USC Conference on Piagetian Theory and the Helping Professions (10th, Los Angeles, CA, February 1-2, 1980).
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS *Cognitive Processes; *Cues; *Memory; *Pattern Recognition; *Preschool Children; Preschool Education; Problem Solving; *Spatial Ability
 IDENTIFIERS *Reconstructive Memory

ABSTRACT

The relative importance of spatial-position as a memory aid in a block pattern reproduction task was investigated by analyzing the object-selection and object-placement strategies of 69 nursery school children. Subjects were given a task modeled on Piaget's assessment of Static Reproductive Images and Action that had been modified into a block-sequencing task. In the experimental condition, a seven-element array of colored geometric forms was shown to the child for 30 seconds, after which the child was requested to copy the array with a second set of blocks that included colors and forms not present in the model. Then, after the model blocks were removed and the reproduction blocks were mixed, the child was asked to rebuild the initial pattern. The experimenter recorded the sequence in which the child chose the blocks to rebuild the array, and recorded the block sequences in the final structure. A total of 138 observations were obtained by giving the task on two occasions, eight months apart, to each subject. Separate analyses were computed for object-selection memory strategies and object-placement strategies. The results provided evidence of young children's reliance upon figurative information in their reconstructions. Both the processes of selection and the products of reconstruction indicated that when the child has the option of choice from competing color, object-identity, or spatial information, memory for the array is cued by spatial information. (Author/RH)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED201402

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

The Dominance of Spatial Memory over Color or Form in

3- to 5-Year-Olds' Pattern Reconstructions

Rodney R. Cocking

Educational Testing Service

Princeton, New Jersey 08541

Presented at the Tenth Annual International
Interdisciplinary UAP-USC Conference on
Piagetian Theory and the Helping Professions,
Los Angeles, CA., February 1 & 2, 1980.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Rodney R.
Cocking

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

PS 012148

The Dominance of Spatial Memory over Color or Form in
3- to 5-Year-Olds' Pattern Reconstructions

Introduction

Studies of reconstructive memory have repeatedly shown accuracy to increase with age (Brown & Murphy, 1975; Chi, 1977; Corsini, 1972; Finkel & Smythe, 1973; Ward & Naus, 1973). The specific memory aids which children and adults use for their reconstructions have been the focus of recent research. Many studies have reported, as a developmental phenomenon, a shift from reliance upon color information among children to object identity, such as form, among more mature subjects. Ward and Naus (1973), however, found that nursery school-aged children, as well as college-age subjects, use object identity over color information, thus limiting the generality of the claim that young children are oriented to color information. Since most of these studies have assessed memory by looking at the subjects' sequential reproductions, it is surprising that more attention has not been given to the spatial information contained in the sequence. An internal representation of the stimulus events, it would seem, has localization information, as well as the color and form cues of the stimulus elements per se.

Method

The major procedural change in the present study was to look at two different behavior sources as children reproduced block patterns from memory. First, children's search through a collection of elements can tell us what they are looking for to complete the pattern; and second,

The Dominance of Spatial Memory

the placement of the elements or the product itself tells us about their attempt to match the image they have of the original stimulus array. Most studies, however, code only the product of the reconstruction as the data of the memory study. In the present study, we looked for disparities between memory strategies as determined by the reaching-for and picking-up of blocks, and the placement of each element into the final array. By doing so, we were able to evaluate the relative importance of the cues of color, form, or spatial-position as memory aids.

Procedures

A task modeled on Piaget's assessment of Static Reproductive Images and Action (Piaget & Inhelder, 1971) was modified into a block-sequencing task. A seven-element array of colored geometric forms (4 colors and 4 shapes without repeats of color/form combinations) was shown to the child for 30 seconds. After the 30-second observation of the block sequence, the experimenter requested that the child copy the array with a second set of blocks which also included colors and forms not present in the model. The copy phase of the experiment was to ensure that each child attended to the array that was to be recalled from memory during the final phases of the study. Following the copy phase, the experimenter destroyed the block arrangements, removed the original model blocks, mixed the remaining blocks, and asked the child to re-build the initial pattern that had been constructed by the experimenter. The experimenter recorded the sequence in which the child chose the blocks to rebuild the array, and after the reconstruction had been completed, the experimenter recorded the block sequences in the final structure. Children

The Dominance of Spatial Memory

were tested individually by one of two women, and testing time ranged from 10 minutes to 20 minutes in duration.

Subjects

Sixty-nine middle-class children (36 males and 33 females), with a mean age of 48.9 months and age range of 35-57 months, from four nursery school programs served as subjects. Each subject was given the task on two occasions, eight months apart, yielding a total of 138 observations. Subjects were given an IQ measure to make certain that memory span was not a function of intelligence and also to adjust for ability across the two age groups, young and old, created by a median age split.

Results

Separate analyses were computed for object-selection memory strategies and object-placement strategies. With respect to overall accuracy of memory for a 7-unit block configuration, all subjects did better than chance. Each element's placement in the overall reconstruction also exceeded chance ($t_{r\phi} = 8.08$, $p < .001$ or better). The results showed a high degree of consistency between the child's selection of elements for the reconstruction and the use of the elements to build the block pattern. For both block selection and block use, spatial-positional information was dominant. This finding, while somewhat attenuated among younger subjects, held across both age groups.

By designating each block with left-to-right position number to indicate an element's position in the 7-element sequence, we can describe the child's strategy as one in which the left block (#1) is used first in

The Dominance of Spatial Memory

the reconstruction, the far right block (#7) is selected second, etc., and the reconstruction pattern is as follows: #1=first; #7=second; #2=third; #6=fourth; #3=fifth; #4=sixth; and #5=seventh. We can contrast this reconstruction sequence with the degree of accuracy for placing each element in its proper location relative to the total array. By considering which block was most often placed accurately, the second most-accurately-placed, etc., the following most-to-least accurate placement sequence emerged: #1=most, or first; #7=second; #2=third; #6=fourth; #4=fifth; #3=sixth; and #5=seventh, or least accurate.

Error analyses were also computed, and this was done by grouping blocks into clusters of three elements. The clusters were identified by the three elements which at the extreme left-side of the array, the three elements at the extreme right-side of the array, or the three that were central to the array. In a 7-element structure, of course, this meant that there was overlap in defining an element as a member of left-side cluster and center cluster, or between a right-side cluster and the central cluster. This over-lap was done to aid in identifying the locus of memory anchoring if spatial position was contributing to either the memory accuracy or misjudgments. We referred to these clusters as initial (left), medial (central) and final (right) to be consistent with other studies which investigate children's scanning strategies, such as reading studies. Error patterns of both choice-strategies and placement-organization produced results which indicated that the children consistently made approximations to correct positions, rather than producing chains of responses built from color or form similarities among elements which might happen if

The Dominance of Spatial Memory

children built sequences of red, green, yellow blocks or triangles, squares, circles, etc. Error analyses indicated that there was a significant error among the three elements to the left of center of the array: the error was to shift an element one unit to the right of the correct position. A significant error among the three elements right of center was a shift one position left of each correct location. These patterns of displacement toward the center of the configuration were significant across all positions and reflected a consistent approach, whether measured through object selection from the random pile of blocks or by the regenerated structure.

Discussion

The results are evidence of young children's reliance upon figurative information in their reconstructions. Both the processes of selection and the products of reconstruction indicated that when the child has the option of choice from competing color, object-identity, or spatial information, memory for the array is cued by spatial information. Other evidence of children's memory being cued by spatial information is seen in research on early picture drawing, specifically human figure drawing (Freeman, 1977).

The present procedure allowed us to consider children's search through collections of elements, much as they look through a toy box when they have something specific in mind. We believe that such a search in assessment procedures indicates whether or not the child is looking for something specific to complete the block pattern. The procedure of this study also enabled us to look at the completed pattern as an index of the child's attempt to match the image of the original array. Most memory assessment, however,

The Dominance of Spatial Memory

reflects only success or failure of the match between a criterion and the child's performance. The additional procedure of coding the child's search, reaching, and placement of elements revealed the relative importance of cues of color, form, and spatial-positional information as memory strategies. The implications of the present research, therefore, lie in the usefulness of devising ways to measure thinking actions, as opposed to relying on thought products, in evaluations of young children.

The Dominance of Spatial Memory

Reference Note

1. Ward, W. C., & Naus, M. J. The encoding of pictorial information in children and adults (ETS RB 73-13). Princeton, N.J.: Educational Testing Service, 1973.

References

- Brown, A. L., & Murphy, M. D. Reconstruction of arbitrary versus logical sequences by preschool children. Journal of Experimental Child Psychology, 1975, 20, 307-326.
- Chi, M. T. H. Age differences in memory span. Journal of Experimental Child Psychology, 1977, 23, 266-281.
- Corsini, D. A. Kindergarten children's use of spatial-positional, verbal, and nonverbal cues for memory. Journal of Educational Psychology, 1972, 63, 353-357.
- Finkel, D. L., & Smythe, L. Short-term storage of spatial information. Developmental Psychology, 1973, 9, 424-428.
- Freeman, N. How young children try to plan drawings. In G. Butterworth (Ed.), The child's representation of the world. New York: Plenum, 1977.
- Piaget, J., & Inhelder, B. Mental imagery in the child. New York: Basic Books, 1971.